Thesis for the degree of cand.med.

Anaemia among women seeking sterilization in Mursan, India.

Authors:

Ragnhild F. Skagseth & May-Liss Hatleskog.

Supervisor: Prof. Dr.med Babill Stray Pedersen.

Faculty of Medicine

University of Oslo, Norway.

February 2009.

Table of contents:

Table of contents

Abstract:

Anaemia in women seeking sterilization in Mursan, India.

Ragnhild F. Skagseth and May-Liss Hatleskog.

Faculty of medicine, University of Oslo, autumn 2008.

Background: Anaemia is a huge medical problem in the developing world. Getting pregnant at a young age combined with high parity, bad sanitary conditions and a bad diet, contributes to give women bad health. This thesis was undertaken to study the haemoglobin (Hb) level in women who were seeking surgical sterilization at the Methodist Public Health Centre (MPHC), Mursan, India. The aim of this investigation was to seek possible explanations why many fertile females end up anaemic and to examine what could be done to improve their condition.

Material and methods: Data were collected from all the women who were seeking surgical sterilization at the MPHC, December 2007. All lab results on Hb level, pregnancy tests and infection parameters were gathered. The authors observed all the tests and contributed in some of the preoperative tests, such as measuring pulse and blood pressure, performing the auscultation of the heart, and bimanual gynaecological examination.

The findings where compared to the existing literature obtained trough search in PubMed, WHO databases, textbooks and Google.

Results: Of 160 women who were seeking surgical sterilization, only 107 (66.9 %) underwent the operation; 25 % of the women excluded had an Hb level measuring 8 g/dl or lower, which is classified as severe anaemia; 4.4 % would not give their consents for sterilization or just left the clinic. 1.8 % tested positive for human chorionoic gonadotropin (hCG) and 1.9 % did not undergo the sterilization of unknown reasons.

Conclusion: Anaemia is without doubt a big problem among women seeking surgical sterilization. There are many reasons contributing to anaemia, such as chronic infections, bad nutrition, and underweight. Possible ways to improve this condition would be family planning, better sanitary conditions, diet and antenatal care. MPHC should focus on working harder on treating infection and especially gastrointestinal infections. The hospital should continue their good work on antenatal care and aim to reach out to even more people in the area. This may increase the frequency of seeking medical help when people feel ill, get pregnant, or are about to go into labour. Iron folic acid (IFA) covering and health education are both successful programs that are recommended to continue.

Aim of study:

The aim of the current study was to evaluate the contributing factors of severe anaemia among fertile women in rural India who sign up for sterilization. Being part of the staff at the clinic in Mursan during 4 weeks including a sterilization camp, the authors experienced some of the immense challenges in health care for a developing country. Infectious diseases, malnutrition and anaemia were even more common than we thought.

Before visiting MPHC the authors had an understanding of the causes leading to high prevalence of anaemia among adolescent girls and women in rural areas of India. However, we wanted to learn more about why these women become fatally anaemic. We also wanted to examine the effects of a common illness like anaemia in situations where the female body is under extra pressure, such as childbirth and surgical procedures like the laparoscopic sterilization preformed at MPHC. What are the costs and what are the benefits for an anaemic woman to go through a sterilization procedure?

Background:

The importance of tracing anaemia in women who signs up for sterilization at MPHC.

This study is a combined observation and literature study discussing the importance of tracing anaemia below 8 g/dl in women signing up for sterilization at MPHC.

The authors attended a sterilization camp at MPHC in the Indian village Mursan in the district of Hathras, Uttar Pradesh, December 13th 2007. At that time the authors had already been at the clinic for about 2 weeks and attended the work there.

Sterilization camps have been arranged in India for about 30 years. It is one of the Indian government strategies aimed at reducing the fertility ratio in the fastest growing country in the world. The government provides women with a certain amount of money to perform sterilization (600 rupees). At the MPHC the clinic subsidised women with 100 rupees extra as a supplement to the money from the government. To undergo sterilization certain criteria had to be fulfilled; the women had to be at least 22 years of age and have at lest 2 living children over the age of 3.

Sterilization of fertile women have the potential of improving the health situation of a given woman. Sterilization can reduce the risk of frequent pregnancies and its potential risk factors like abortions, atonic bleeding, stillbirths, birth trauma, thrombosis, exlampsia and even death. Frequent pregnancies, giving birth and breastfeeding for a year, two or more is an extra load for the female body, and have the potential of depleting the woman's iron stores to a higher degree than only having a period of menstruation every month.

Sterilization, like every other surgical procedure, has a set of potential risk factors that might harm the patient in both short and long terms. There are risks during the anaesthetic procedures; risks of injuries to gut, bladder or vessels during the surgery; risk of bleeding; risk of no effect of the surgical treatment; risk of infections; and risk of death.

Sterilization has the potential of reducing the degree of iron deficiency anaemia in fertile women by preventing frequent pregnancies and its potential risk factors. At the same time, laparoscopic sterilization, or any kind of surgery, represents a potential harmful procedure especially for a moderately to severe anaemic person. This is because of the increased risk of bleeding (1), infection, and reduced general and postoperative healing (2) in women with moderately to severe anaemia.

At the sterilization clinic at MPHC several parameters and criteria were evaluated before the surgical procedure was performed to examine if the patient were fit enough to go through the operation. A lower limit of 8g/dl Hb were one of the criteria. This is 4 g/dl lower than WHOs haemoglobin threshold to define anaemia. 8g/dl Hb is the lower limit of moderate anaemia. Values below 8g/dl Hb is defined as severe anaemia (3).

There was a high prevalence of anaemia among adolescent girls and women, both pregnant and non pregnant, at the MPHC According to WHO, iron deficiency anaemia is considered to be among the most important contributing factors to the global burden of disease. Anaemia has an overall prevalence of 1.6 billion affected people globally, which corresponds to 24.8% of the world's population. The population group with the greatest number of affected is non-pregnant women; 468.5 million globally (4). WHO also estimate that the highest proportion of affected individuals is in Africa, whereas the greatest number affected is in South-East Asia. Europe has the overall lowest prevalence of anaemia. It must however be noted that the many different parameters used to measure anaemia might impact the huge differences observed in anaemia prevalence between the continents mentioned above.

The largest and most apparent difference between the population of Norway and Mursan is that most of Mursan's inhabitants are poorer than most Norwegians. They have poorer sanitary conditions and a poorer diet. Most of the inhabitants are Hindus, implicating that women are not supposed to eat meat. The female diet thus consists mainly of vegetables, rice and bread. Most vegetarians in Norway are aware of the limitations in their diet, and take necessary supplements to prevent malnutrition. Vegetarians are prone to have vitamin B12 deficiency, and thus have to eat more greens high in protein too keep up their protein intake. In addition to having a vegetarian diet, the authors observed that the Mursan women were rather slim. The womens height and weight were not measured, yet the authors observed that a majority of the female population was slim, and some of them were beyond doubt underweight.

Most Mursan women get married between the age of 15-20, and most of them get pregnant within a year ore two. Most couples have at least 2 or 3 children, and the offspring are born within short intervals. In addition, miscarriages and stillbirths have high prevalence. Sexual transmitted infections (STI) could possibly be one of the main contributors to spontaneous abortions and stillbirths. Syphilis is a very common STI in India. Couples relatively

frequently came to the clinic complaining about repeated miscarriages, both early and later in the pregnancy. Tests showed that many of the couples where infected with syphilis that is known to have the potential to lead to miscarriage or stillbirth.

Anaemia in fertile women

Anaemia is a symptom of disease that is considered to be among the most important contributing factors to the global burden of disease (4).Several factors and diseases can cause anaemia, and both the aetiology and the amount of people affected vary widely between continents, countries, sex and age. There is a 85.6 % prevalence of anaemia among pregnant women in South-East Asia, compared to 8.3 % in Europe (Table 1).

Table 1. **Worldwide prevalence of anaemia 1993-2005**

WHO region	**Children 0-5 years PreSAC[a]**	**Pregnant women PW**	**Non Pregnant women NPW**	**Children 5-15 years SAC**	**Men 15-60 years Men**	**Elderly above 60 years**	**All**
Africa (46)[b]	74.6 (26)[b]	65.8 (22)	61.4 (23)	13.2 (8)	21.9 (11)	0.0 (0)	40.7
Americas (35)	76.7 (16)	53.8 (15)	56.2 (13)	47.1 (9)	34.3 (2)	47.6 (1)	58
South-East Asia (11)	85.1 (9)	85.6 (8)	85.4 (10)	13.6 (3)	4.1 (2)	5.2 (1)	14.9
Europe (52)	26.5 (12)	8.3 (4)	28.0 (12)	9.3 (3)	14.1 (3)	8.0 (2)	22.9
Eastern Mediterranean (21)	67.4 (11)	58.7 (7)	73.5 (11)	15.5 (6)	27.5 (6)	3.2 (3)	84.3
Western Pacific (27)	90.4 (10)	90.2 (8)	96.9 (13)	83.1 (7)	96.2 (10)	93.3 (6)	13.8
Global (192)	**76.1 (84)**	**69.0 (64)**	**73.5 (82)**	**33.0 (36)**	**40.2 (34)**	**39.1 (13)**	**48.8**

[a]Number of countries in each grouping

[b] Total number of countries with data, no figure is provided for All since each country may be partially covered by some population groups, but few countries have data on all 6 population groups and no countries have data for women 50-59 yrs of age

(5)

These numbers from WHO reveal the big differences in number of countries in each group providing data on anaemia. There are for instance no African countries providing data about the prevalence of anaemia among elderly persons.

Table 2. WHO; signification of anaemia as a public health problem.

Prevalence of anaemia (%)	Category of public health significance
<4.9	No public health problem
5.0–19.9	Mild public health problem
20.0–39.9	Moderate public health problem
>40.0	Severe public health problem

(4)

According to table 2, anaemia prevalence more than 40% is considered to be a severe public health problem. As shown in table 1, anaemia in both pregnant and non pregnant women in South-East Asia is more than 85%.

Anaemia is strictly defined as a decrease in red blood cell (RBC) mass. Measuring RBC mass in clinical practice is not often done because it is time consuming, is expensive, and usually requires transfusion of radiolabel erythrocytes. In most clinics and hospital anaemia is traced by measuring the amount of Haemoglobin (Hb) in the blood. Anaemia is defined as a Hb below a certain value, depending on the sex, age, and in case of a female patient depending on if she is fertile, pregnant or not.

Table 3. WHO classification of anaemia

Age, sex	Anaemia
Pregnant women	Hb < 11 g/dl
Non- pregnant women (> 15 years)	Hb < 12 g/dl
Men	Hb < 13 g/dl
Children (0.5-4.99 years)	Hb < 11 g/dl
Children (5.00-11.99 years)	Hb < 11, 5g/dl
Children (12.00-14.99 years)	Hb < 12 g/dl

(4)

Hb is a test that examines the amount of haemoglobin in the blood. Haemoglobin is a red pigment located inside the erythrocyte cell. The hem-molecule carries oxygen from the lungs to central and periphery tissues in the body. It is always important to consider the Hb test in addition to clinical information like pulse, blood pressure and other tests like ferritin. In severe cases of anaemia the low haemoglobin fraction in the blood makes the heart work

beyond its demands to supply the body with sufficient oxygen. This might lead to a “high output heart failure” (6).

The Hb test is a cheap, simple and rapid test that requires little equipment. The test is however prone to several limitations that might give a false to high, or a false to low Hb in a given clinical situation. It is therefore even more important to consider the Hb-value in relation to other parameters. For instance, the degree of hydration of the patient makes an impact on the measured Hb. A low hydration status will give a false high Hb, and a patient that is over-hydrated will have a false low Hb. Patients with pronounced hyperlipidemia or leukocytosis are also likely to have a false high Hb. In pregnant women it is quite common to find a false low Hb. This is due to a physiological increase in plasma volume during pregnancy.

To confirm whether an Hb result is false low or false high, every patient reporting specific symptoms of anaemia or have an Hb below the reference margin should undergo additional tests. There are several tests that might give information about whether the patient have anaemia or not, the degree of anaemia, and further information concerning the aetiology of the anaemia. This study focused on pregnant and fertile woman with anaemia. The most common reason for anaemia in this group is iron deficiency anaemia, which could easily be detected by blood tests like ferritin, total iron binding capacity (TIBC) and looking at a blood film slides in the microscope.

Iron deficiency is the single most important mineral deficiency worldwide. It is also the single most important reason for anaemia (4). The most important additional test when it comes to iron deficiency anaemia is measuring the ferritin value. Ferritin is an intracellular protein that stores iron in the body. There is also an amount of ferritin that is glycosylated and released into the bloodstream. The amount of ferritin in the bloodstream and intracellular ferritin is almost always proportional. A simple blood test can therefore give an approximate picture of the patients iron stores. A ferritin value of less than 10 is diagnostic for iron deficiency. Iron deficiency will eventually lead to iron deficiency anaemia. Ferritin is also an acute phase protein, which means that the value can be false high if the patient has an infection when the blood test is done (7). Iron deficiency can also have non-haematological effects in addition to causing anaemia. With low values of iron the white blood cells loose some of its bactericide quality and the immune system gets weaker. Iron is a component in many important enzymes and proteins. It is known that iron deficiency can cause cognitive impairment, feeling of being fatigued, and in children it can cause reduced attention and learning skills. (2)

There are several causes and aetiologies that might lead to anaemia. Some of them are more likely to affect fertile women in rural India, with iron deficiency anaemia being the single most important cause. Table 4 shows other relevant causes of anaemia for fertile women in India. The most important causes are marked with bold letters.

Table 4.

Causes of anaemia	**Aetiology**
Genetic	Hemoglobinopathies **Thalassemias** Enzyme abnormalities of the glycolytic pathways Defects of the RBC cytoskeleton Congenital dyserythropoietic anaemia Rh null disease Heriditary xerocytosis Abetalipoproteinemia Fanconi anaemia
Nutritional	**Iron deficiency, vit. B12 deficiency, folic acid deficiency, starvation and generalized malnutrition.**
Hemorrhage	**Menorrhagia, miscarriages, childbirth**
Pregnancy	**Lactation, increased demands**
Physical effects	Trauma, burns, frostbite, prosthetic valves.
Drugs and chemicals	Aplastic anaemia, megaloblastic anaemia
Chronic diseases and malignancies	Renal diseases, **hepatic disease**, **chronic infections**, neoplasia, collagen vascular diseases, hypothyroidism
Infections	Viral **hepatitis**, infectious mononucleosis, cytomegalovirus Bacterial clostridia, gram-negative sepsis Protozoal**- malaria, hoochworm**, leismaniasis, toxoplasmosis
Immunologic	Antibody- mediated abnormalities
Drugs and chemicals	Aplastic anaemia, megaloblastic anaemia
Others	Trombotic thrombocytopenic purpura and haemolytic uremic syndrome

(8)

As listed above there are several different factors that contribute to anaemia. But there are some factors that are more likely to give anaemia in fertile and pregnant women in a tropic, developing country. There are many vegetarians in India. Furthermore, those who eat meet do not normally eat as much red meat as we do in Norway. This might both be because of

religion and poverty. Hindus resent killing living organisms (9). Consequently many Hindus are vegetarians. Most women in Mursan are both Hindus and vegetarians, and their diet mainly consists of vegetables like carrots, rice, and chapatti bread. This gives a faulty dietetic habit because it is a diet high in carbohydrates and quite low in proteins and fat. A diet high in carbohydrates gives a high content of phosphate and phytic acids. Phosphate and phytic acids react with free iron, producing insoluble iron phosphates and phytates in the gut which are not absorbable. This decreases the absorption of iron (10).

There is a high prevalence of gastrointestinal infections all over India, partly due to bad sanitary conditions. Gastrointestinal infections entail shorter food transition time trough the gut, which again causes a reduced uptake of nutritional content in the diet, as well as minerals like iron and potassium (10).

In a warm climate people loose more minerals trough sweat. It is estimated that a person can loos as much as 15 mg of iron a month through sweating. It is also estimated that a subsidy of 15 mg orally a day will replace the normal physiological loss that is estimated to be approximately 1.5 mg a day for a healthy person. This means that for a healthy person there is an absorption rate around 10 % (10).

There has been an enormous drop in the reported fertility rate in India from 5 in 1980 to 2.9 in 2006 (11). According to Reidun Refsdal, midwife and missionary at MPHC, this is only partly true. A couple of years ago the Indian government asked the MPHC to file and report to the government all the births the clinic was involved in. However, when MPHC sent their reports, the government was no longer interested in the information they had previously requested. In addition many women in both rural and urban areas do not have enough money to go to a clinic to give birth. Furthermore, many women live too far away from the public hospitals or do not have enough trust to the public hospitals. These women give birth at home and most of the time they do not report to the government that a child is born. This indicates that there are many births in India that are not reported to the government, and are therefore not part of the fertility statistics. Consequently, when WHO report a 2.9 fertility ratio in 2006, the real number might be higher (13). The fertility ratio does not include information about the total amount of pregnancies. A quite high number of pregnancies in rural India end up in miscarriages and stillbirths. Even short-ended pregnancies will be a burden to the female body and contribute to the development of anaemia.

It is estimated that a healthy woman will loose about 1000 mg of iron during the process of pregnancy, childbirth and lactation. Furthermore, it is estimated that women with an adequate diet will use about 2 years to replace the estimated loss of iron. Hence, if a woman gets pregnant less than 2 years after ending one lactation period, she will probably not have replaced the iron loss, and thus increase the risk of developing anaemia or even deteriorate the already existing anaemia. The fact that a big fraction of women in rural India go trough pregnancy at a young age when their bodies are still growing and in need extra supply of iron, could also contribute to the high fraction on anaemic females in India (10).

In rural India a high proportion of the population have chronic infections like malaria and hookworm. Malaria gives a chronic blood loss because of bleeding piles and dysentery, causing iron deficiency anaemia. Hookworm infections cause a blood loss that is estimated to be about 0.5 – 2 mg of iron a day. One hookworm extracts about 0.05 ml of blood a day. The presence of infection on its own interferes with the erythropoiesis because it gives a suppression of the bone marrow (10).

The increased risk of bleeding with anaemia is related to the hemodynamic mechanism in the blood vessels. Normally the red and white blood cells flow through the vessel in laminar flow in the middle of the vessel. Red and white blood cells, which are bigger then the trombocytes, press the trombocytes against the vessel wall as they flow through the vessel. The trombocytes consequently is in an optimal position in case of damage to the vessel wall; they can easily adhere and stop the damage or bleeding. In an anaemic person the amount of red blood cells is less than normal, and the pressure from the red blood cells towards the trombocytes and the vessel wall is less, which increases the risk of bleeding. This phenomenon is called “the tromboblastic effect of the erythrocytes” (1).

Material and method.

The data and information for this study was collected during the authors' four week stay at the MPHC. The methods of collection were conversations with the local doctor, Dr Mamta Kaushal; examining registrations done in the laboratory by Mr Manjol Lall; and conversations with the rest of the staff . In addition, Reidun Refsdal, the leader at the clinic, assisted with translation and everything else that the authors were wondering about. During the stay the authors collected clinical information and observed all the consultations between Dr Mamta Kaushal and the patients, as well as examining the patients their selves. The authors learned to perform antenatal examinations of pregnant women which included bimanual gynaecological examination, measuring symphysis-fundal height, measuring the foetal heart rate with Doppler, and measuring blood pressure and weight. Furthermore, the authors assisted in delivering babies and vaccinating children. On a few occasions they also inserted IUD and did curettage after missed abortions.

To get sufficient background information the authors combined this observation study with a literature search of the existing knowledge on this subject. Search motors on Internet used; PubMed, WHO, DUO, Google in addiction to text books gave information to compare the results from the current study and to get more information. The following search criteria in PubMed were used; anaemia, sterilization, fertile women and India.

Results:

Sterilization camp, 13/12 2007.

The sterilization camp at MPHC was a “drop in” camp. The staff at the clinic had no presumptions of how many women might show up on the day of the camp. However, already at 7 a.m. there was a long queue of women waiting to sign up for the camp. The camp worked after the “first come, first served” principle, the first in line was the first to get through the sterilization. After about 4 hours, 160 women had signed up for registration. Before sterilization was to be performed, the women had to be examined by one of the two doctors and undertake blood tests. The following parameters were included:

Inclusion criteria:

- Age between 22-45 years
- At least two living children over the age of three years
- Generally good health condition
- Wanting family limitation

If the women fulfilled these criteria they had to take blood and urine tests.

Laboratory test:

Blood:

- Hb
- HIV
- HBsAg

Urine:

- hCG (pregnancy test)
- Albumin
- Microscopy of urine if needed.

The laboratory results were available within short time, and the patients got a card with their data and findings. The nurses informed them about the procedure. The last stop before starting the anaesthesia was the doctor’s examination. The doctor examined:

- Blood pressure
- Pulse
- Auscultation of lung and heart

- Bimanual gynaecological examination. The doctor also noted whether the uterus was anteverted or retroverted to help the surgeon to find the tubes more easily during the operating procedure.

The following exclusion criteria were also measured:

Exclusion criteria:

- Positive HIV, hCG or HBsAg
- Hb below or at 8 g/dl
- Too low or too high blood pressure
- Enlarged uterus (due of the risk of perforation and subsequently bleeding during the operation.)
- Discharge from the cervix. Discharge is an indicator of infection. Infection can give postoperative complications (12).

Of the 160 women who signed up for sterilization 107 (66, 9 %) went trough the surgical procedure.

Severe anaemia (<8 g/dl) was the main reason why so many women were excluded from the procedure.

Of the 160 women who signed up for sterilization 53 were excluded.

Table 5: Women excluded from sterilization. Numbers in percentage.

Women had a Hb =/< 8g/dl	**40**	**25 %**
Women tested positive for hCG	**3**	**1.8 %**
Women wouldn't give their consent or just left	**7**	**4.4%**
Unknown reasons	**3**	**1.9 %**

With good assistance from Reidun Refsdal, the authors were able to collect further data from camps prior to the one we attended, and from some camps that took place after we left. Numbers from these camps only show how many women showed up, as well as how many underwent the procedure:

December, 2005: 200 signed up for sterilization, 167 sterilized (83.5 %).

March, 2007 : 154 signed up for sterilization, 124 sterilized (80.5 %).

February, 2008 : 108 signed up for sterilization, 86 sterilized (79.6 %).

Approximately 500 women were sterilized at MPHC in 2007 (13).

Clinical observation:

If the doctor got the impression that a given woman was anaemic the doctor examined her for clinical signs of anaemia.

It is difficult to discover anaemia in Indian patients because of the dark skin. Indians also have different skin colours depending on where in India they are from. For instance, some south-Indians in Mursan have darker skin colour compared to north-Indians.

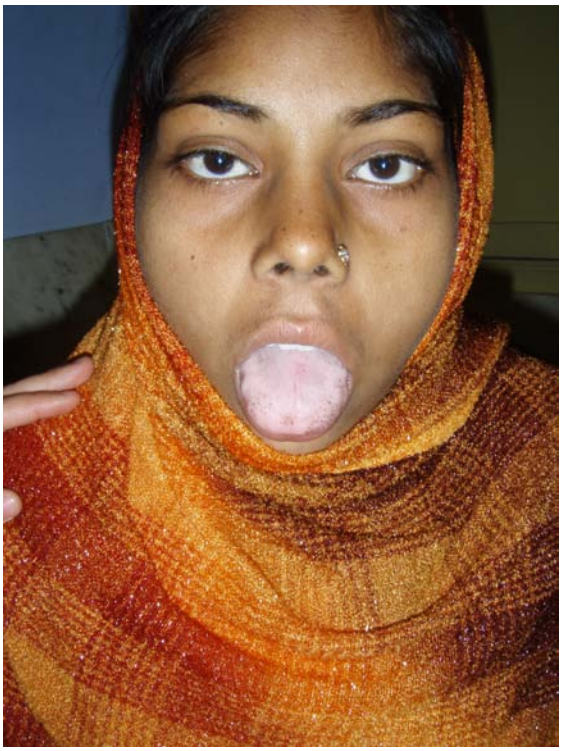
The authors found that it became easier to look for clinical signs after examining several patients even in patients with dark skin. Tracing anaemia by looking at the colour of the skin is hard in dark skinned people. But if the patient is paler than expected this might give an impression that the patient is anaemic. Also, the following observation methods were considered: the mucosa in the mouth and conjunctiva, and the lining of the tongue and the nail bed.

Picture 2. Anaemic girl.

Anaemic woman with pale conjunctiva. photo: May-Liss Hatleskog

The patient in picture 2 had severe anaemia, Hb measuring 7 g/dl. She had a pale conjunctiva and her skin was also paler than expected. She furthermore complained about feeling tired and weak.

Picture 3. Anaemic girl.



Anaemic woman, atrophic tongue. photo: May-Liss Hatleskog

The woman in picture 3 is the same as in picture 2. Her tongue is pale, almost white, and she had some black dots on the left side of her tongue. The doctor examining the woman stated that she often observed these black dots on anaemic women's tounges, but she did not know the biological reason. (14)

The oral mucosa often gets pale in anaemic persons. The tongue can get atrophic and depapillated (14).

Causes of anaemia.

Conversation with the patient on the pictures above revealed that she just ate one or two chapatti a day. All Hindu women in India are vegetarians, and consequently do not eat meat. This woman was Hindu and her family was very poor. She explained that she ate only chapatti because she could only eat “cold” foods during the winter. “Cold” food is not connected to the temperature of the food, but is determined by the character of the food. Many Indians think that a balance between warm and cold food is necessary for good health and wellbeing. For example, spice and chilli is warm food and yoghurt, bread and rice is cold food (15).

The anaemic girl in the pictures above came from a very poor family who could only afford one chapatti for her to eat a day. Conversations with several patients further revealed that they did not know much about nutrition and the needs of the body. Especially, there was a lack of knowledge of the diversity of nutrition and minerals the body needs, and the importance of having an iron rich diet.

Dr. Mamta Kaushal also pointed out infection as an important contributor for the high prevalence of anaemia among women in rural India (14). During the 4 weeks in December 2007 three women tested positive for malaria infection with plasmodium Vivax at the MPHC. These women were anaemic and received treatment with the anti-malaria drug Kinolon (klorokinin). One woman tested positive for typhoid fever, she was also anaemic.

Several women tested positive for syphilis, however not all were anaemic. Some of these women contacted the clinic because of infertility and tested positive for syphilis. The clinic provided treatment for the syphilis and informed that their husbands also needed treatment. It is a big problem in India that men often refuse treatment for sexual transmitted diseases like syphilis (13). However, Dr. Mamta Kaushal did a great job trying to educate the men, and educated them of the importance of having both men and females treated.

Dr Mamta Kaushal told that many children and women in the area we visited were likely to have hookworm infection (14). There were no testing for hookworm infection at the MPHC, but many anaemic children and women received treatment for worm infections based on clinical findings. The bad sanitary condition in Mursan forces the citizens in the village to go to the toilet in the fields, where they also collect much of their food. Some also use the water channels in the streets as toilet. Most of the women and children were barefoot, and worm can

easily go through the skin and into the circulation. Hookworm can give anaemia because they suck blood from the host. The hookworm attaches themselves to the upper part of duodenum. The blood loss is positively connected to the hookworm's size and the number of hook worms in the infected person (16).

Discussion:

The current study's data and information is based on the observations the authors did whilst staying at the MPHC The data was collected with good help from the laboratory staff at the clinic. A limitation concerning the measurement of Hb in this study is that the authors did not check the equipment used for analysis. This might have impacted the reliability of the findings.

Another limitation is that the classification of anaemia varies from country to country, and organisation to organisation. Some tropic countries with a high prevalence of anaemia operate with a lover threshold for the anaemia classification. Compared to Norwegian standards, anaemia in India is a more common condition and mild anaemia might easily be overseen.

Anaemia as a part of the big picture.

India is currently probably the most populated country in the world. At the same time, it is of the poorest countries in the world with millions of people struggling every day through poverty, hunger and diseases. There has however been impressive improvement in most health indicators during the last two decades, including a reduction in infant mortality rate from 115 in 1980 to 57 in 2006 (17). During the same period there have been a drop in the total fertility rate per woman from 5 to 2.9. Improvement in nutritional status has however been less impressive. More than half of the world's undernourished population lives in India, and half of the Indian children are malnourished (18).

The authors of this study found that severe anaemia was a big problem for fertile women who signed up for sterilization at MPHC 25% of our patient group had an Hb level below or equaling 8 g/dl. Numbers collected from WHO show an anaemia prevalence of 85.4 % in non-pregnant women in South-East Asia. WHO use Hb below 12.0 g/dl as threshold level for anaemia in non- pregnant women (19).

The National Family Health Survey 3 (NFHS-3) is a big study conducted in India in all the 28 states, including Delhi. The survey started in February 2005 and ended in December 2006. It was conducted under the guidance of the Ministry of Health and Family Welfare (MOHFW) in India. The first survey, NFHS-1, was conducted in 1992-1993, followed by the second survey NFHS-2 in 1998-1999.

This NHFS-3 study has among other topics investigated maternal health. The survey showed that more than half to two-thirds of women, whether pregnant or not, is anemic. This prevalence has increased since NFHS-2.
The NHFS-3 survey also examined the use of IFA (iron folic acid) tablets. It is recommended to use these tablets for a period of 90 days during pregnancy by the Reproductive health and child program (RCH). In Uttar Pradesh, the state of Mursan, only 8.7 % of women used it during the last pregnancy (20).
In 1970 the Indian Government launched a national anaemia prophylaxis program. The aim was to improve nutritional status and reduce anaemia in children and women of reproductive age. NFHS-3 shows that this prophylaxis program has failed. The survey points out poor IFA coverage and absence of program focus as the biggest problem (21).

Anaemia and laparoscopic surgery

There is no doubt that anaemia is a big problem for India and for the patients who wanted to sign up for sterilization at MPHC. Severe anaemia is dangerous when it comes to laparoscopic surgical procedures. The biggest problem is the risk of bleeding. On the other hand, sterilization can prevent anaemia since pregnancy and lactation itself increases the risk of anaemia.
MPHC has practices very strict inclusion- and exclusion criteria at the sterilization camps. This may explain why the clinic has relatively few operative and postoperative complications. Considering all the tests performed before sterilization, and the strict exclusion criteria, MPHC seem to have a system that works.
Another study examining the quality of the sterilization camp at MPHC found that MPHC had better conditions than recommend by the Indian Government when it comes to sterilization and safety (22).

However, if a threshold of 8 g/dl is the correct exclusion criteria when it comes to laparoscopic surgery is another question. From a Norwegian point of view this threshold is quite reasonable. The biggest hospital in Norway, Ullevål university hospital (UUS), uses a threshold on Hb on 7-8 g/dl on elective laparoscopic surgery. Most women having a laparoscopic intervention on day-time basis do not have any guidelines for checking the Hb-level.
When performing acute laparoscopic gynecological procedures, as in extra uterine pregnancy, UUS operate on even lower limits. In acute cases like this UUS aim to use the most

experienced surgeon, and transfusions are given during the operation if needed (23). At MPHC they did not have access to blood to perform blood transfusions if necessary during the sterilization camp. The public hospitals do however have access to blood for transfusions, but the lack of safe blood is still a huge problem in India (13). Hypothesizing that anaemic women are at higher risk of bleeding, as well as postoperative infection and poorer recovery after sterilization, it was not easy to find evidence of this in the literature. A high proportion of fertile women in India have anaemia, and many of the women undergoing sterilization have mild to moderate anaemia. Most sterilization camps in India operate with an inclusion limit of Hb of 7 or 8 g/dl Hb or higher. This threshold seems to be reasonable as it does not put the women under intolerable risk of bleeding. The overall risk of having a big bleeding during or after a sterilization camp in India was between 0.03-0.5 %, and the risk of having infections afterwards is between 0.1-0.6 % (24). These numbers are low, especially when we know that most camps are accomplished in rural, small clinics – and even in schools where the standards compared to surgical wards in the western world is quite appalling. It is important to remember that some of the most important factors contributing to surgical and postoperative complications – and even death rates are related to the surgeon and how skilled and experienced he or she is with laparoscopic sterilizations (25).

Many reasons for anaemia

After closely examining the topic of anaemia the authors of the current study have observed many reasons and ways to become anaemic. Malnutrition and chronic infections are certainly big contributors to anaemia. In an intestinal parasitic prevalence study, the result was that 11.5 % of the studied population had an intestinal infection. The study was performed in Lucknow, one of the big cities in Mursan surroundings. 1070 stool samples from the urban and rural areas of Lucknow were collected. In this study Giardia Lamblia was the most common pathogenic protozoan detected, but many also suffered from hookworm and soil transmitted helminths (16). This study show that Giardia Lamblia is highly prevalent in the Mursan area and that it can be easily treated with an antibiotic; metronidazole. This indicates that MPHC could possible investigate for Giardia Lamblia and treat if the patient is infected.

Diet is also a big contributor to anaemia. One hypothesis is that rural, slim women would have a higher prevalence of anaemia, compared to more urban women with higher income and BMI. Mursan is a town with 30 000 inhabitants, and is in India classified as a rural area. In Mursan the population had access to primary health care at the MPHC, and a bigger

hospital would be about 1 hour drive away. Mursan is also the centre for smaller, surrounding villages that would be classified as even more rural than Mursan. One study done in an Indian state showed that more than 37 % of rural women had a BMI of less than 18.5 kg/m^2, which is classified as underweight. This finding is almost 3 times higher compared to urban areas, where about 12 % of women were underweight. When it comes to overweight, which is classified as more than 25 kg/m2, the percentage is 7.3 % in rural areas, compared to 37 % in urban areas. The biggest disparities in nutritional status were primarily related to women's access to resources and income, including better diets and access to healthcare, regardless of whether they lived in rural or urban areas (18).

Conclusion:

The authors of the current study found many cases of severe anaemia in the population group. 25 % of the examined women had a Hb below 8 g/dl, which classifies as severe anaemia. It is difficult to compare this finding directly to numbers found in WHO-studies because of different limits in measuring anaemia. WHO-findings indicate that 85.4 % of non-pregnant women in South-East Asia are anaemic. WHO uses a threshold of 12.0 g/dl, including all categories of anaemia (19).

This study reveals several reasons why fertile women in India become anaemic. First of all, many women have poor nutrition. The amount of food is often not enough for the daily demands, and the amount of carbohydrates is high compared with the amount of proteins and fat. Many women have a BMI below 18.5 kg/m^2, and are classified as underweight. Secondly, several childbirths within short intervals also increase the body's need of iron. Furthermore, chronic infections such as syphilis, malaria and hookworm are highly prevalent and affects the entire population, not only the fertile women. Poor use of IFA during pregnancy, as well as a lack of antenatal follow-up during pregnancy, increases the risk of women suffering from mild anaemia prior to pregnancy to end up with a severe anaemia within a short period of time (20).

The authors also found that MPHC is performing important tests and have good guidelines in terms of examination of women wanting sterilization. The staff has good routines and the authors observed good team work at the sterilization camp. We compared the Hb threshold used in Norwegian hospitals prior to laparoscopic surgery, with the threshold used at the sterilization camp at MPHC. Findings reveal that they are in fact rather similar.

Doctors at MPHC are aware of anaemia as a big health problem, and they are skilled in performing examinations for anaemia. The suspicion of anaemia is confirmed with blood tests, and subsequently treated with intramuscular iron and oral iron tablets.

The MPHC is working hard to get more women sterilized, and they also try to give out information about contraception. They give out contraceptive pills to young women who do not want to get pregnant. When we left the clinic they were planning a sterilization camp for men.

We hope that MPHC and the Indian Government will work harder for education the population in diet, nutrition, and IFA. Chronic infections are still a big, relapsing problem that

deserves more focus. It should be possible to check more stools and give treatment if there are pathological bacteria in the stool. We found that Giardia Lamblia infections are highly prevalent in the Mursan area. This a big problem and the government should prioritize getting clean water and better sanitary conditions.

The MPHC has done great work in terms of reproductive health, pregnancy and delivery, contraception and sterilization; preventing unwanted pregnancies and making the intervals between each pregnancy longer. All of this is contributing to reducing the fertility ratio. Most importantly, MPHC`s work is preventing anaemia which is considered to be among the most important contributing factors to the global burden of disease.

References:

1.) Brosstad F. Hemostasemekanisme I: Stokke O, red. Klinisk biokjemi og fysiologi. Oslo: Gyldendal Akademisk 2 utgave, 2004: 23-36

2.) Stokke O, Jern og hemoglobinstoffskiftet I: Stokke O, red. Klinisk biokjemi og fysiologi. Oslo: Gyldendal Akademisk 2 utgave, 2004: 49-59

3.) Norsk elektronisk legehåndbok, Anemi. [Database] http://www.legehandboka.no/ (19.01.09)

4.) WHO Global Database on Anaemia Worldwide prevalence of anaemia 1993–2005 http://whqlibdoc.who.int/publications/2008/9789241596657_eng.pdf (19.01.09)

5.) De Benoist B et al., eds. Worldwide prevalence of anaemia 1993-2005. Global Database on Anaemia, Geneva. http://www.who.int/vmnis/anaemia/prevalence/anaemia_status_coverage/en/index.html (7.11.08)

6.) Ilbekk A, hjertets patofysiologi I: Stokke O, red. Klinisk biokjemi og fysiologi. Oslo: Gyldendal Akademisk 2 utgave, 2004: 189-209

7.) Norsk Elektronisk Legehåndbok, Ferritin [Database], Sverre Sandberg and Geir Thue, http://www.legehandboka.no/ (01.09.08)

8.) eMedisine, WebMD. Anemia. [Database] Marcel E Conrad, (2008). from http://www.emedicine.com/med/topic132.htm#section~AuthorsandEditors (28.08.08)

9.) Alf Petter Bu, Hinduisme, Feltprestkorpset. Religion i forsvaret. http://www.mil.no/felles/fpk/religion/start/saksbehandlig/Bekledning__kosthold__sykdom_og/hinduisme/ (08.11.08)

10.) Dutta DC. Textbook of Obstetrics. 3rd Edn. Calcutta: Central Book Agency, 1992

11.) World Health Organization. Core health indicators, the latest data from multiple WHO sources. http://www.who.int/whosis/database/core/core_select_process.cfm (08.11.08)

12.) H. Moaddab and S. Sajadian. Female surgical sterilization in Mursan, India. [student thesis], spring 2008

13.) Personal communication: Reidun Refsdal, (Methodist Rural Public Health Centre) communication during the stay in Dec. 2007 and over e-mail in February 2008.

14.) Personal communication: Dr. Mamta Kaushal (Methodist Rural Public Health Centre) Conversation during the stay in Dec. 2007

15.) I. Hansen og H. Andersson. Årsaksbegreper og helseatferd i indisk folkemedisin. Tidsskriftet for den norske legeforening 2007; 127:3278-81.

16.) Nitin, Venkatesh and Husain. Overview of intestinal parasitic prevalence in rural and urban population in Luknow, north India. J. common dis. 2007; 39(4) 217-23.

17.) World Health Organization. Statistics information system http://www.who.int/whosis/database/core/core_select_process.cfm.(22.10.08)

18.) ME. Bentley and Griffiths. The burden of anaemia among women in India. European journal of clinical Nutrition 2003; 57, 52-60.

19.) World Health Organization. Global database of anaemia. http://www.who.int/vmnis/anaemia/data/database/countries/ind_ida.pdf (01.08.08)

20.) C. Lahariya, J. Khandekar. How the findings of national family health survey-3 can act as a trigger for improving the status of anaemic mothers and undernourished children I India: A review. Indian Journal of medicine, 2007; 61:534-544

21.) Government of India. NFHS-3 www.nfhsindia.org (23.10.08)

22.) M. Svensk and P. Wikborg. Female sterilization in India, the quality and effect of an observed sterilization camp at the M.P.H.C. [student thesis] 2007

23.) Guidelines of laparoscopic gynaecological surgery. E-mail correspondences with Anton Langbrekke, prof. dr. med. at the women's diseases at Ullevål university hospital in Norway. Correspondences in August 2008

24.) Metha, A total of 250136 laparascopic sterilizations by a single operator. British journal of Obstetrics and Gynaecology 1989; 96, 1024-1034

25.) Bratt, Camp laparascopic sterilization deaths in Gujarat State, India, 1978-1980. Asia Ocean Journal of Obstetrics and Gynaecology 1991; 17, 297-301